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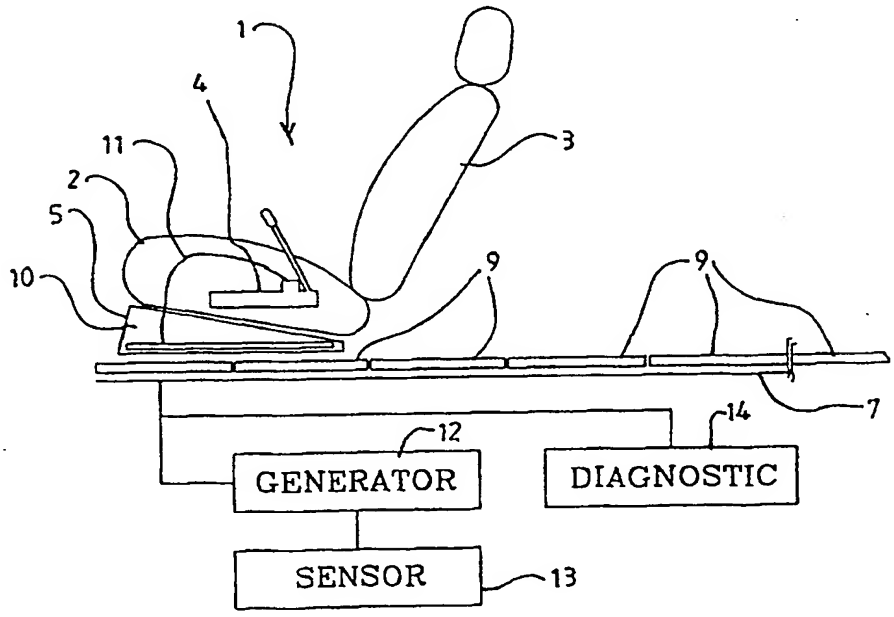

(57) Abstract

A safety arrangement for use in a motor vehicle, the safety arrangement comprising a rail (7) provided on the floor of the vehicle and a vehicle seat (1) movably mounted on the rail means, the rail means being associated with one or more transmitting antennas (9) and the seat being associated with one or more receiving antennas (10), and means (12) to supply a signal to at least one transmitting antenna to transfer power to at least one receiving antenna, there being a safety device (4) mounted in or on the seat, actuating means being provided to use the power transferred to the said receiving antenna to actuate the said safety device.

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A SAFETY ARRANGEMENT FOR USE IN A MOTOR VEHICLE

THE PRESENT INVENTION relates to a safety arrangement, and more particularly relates to a safety arrangement in a motor vehicle such as a motor car.

It has been proposed previously to provide safety arrangements in a motor car, which are adapted to be activated in the event that an accident should occur, with the safety arrangements incorporating devices mounted on the seat of the motor vehicle.

For example it has been proposed to provide an inflatable air-bag, initially stored within the back-rest of a vehicle seat, the air-bag being adapted to occupy a position between the main part of the torso of the occupant of the seat and the side of the vehicle in the event that an accident should occur. Also, it has been proposed to provide a pre-tensioner mounted directly on the seat of a motor vehicle, the pre-tensioner being adapted to apply tension to a seat belt in the event that an accident should occur, so as to retain the person wearing the seat belt firmly in position in the seat.

It is known that seats may be adjustably mounted in position within a motor vehicle, with the seats sliding forwardly and rearwardly along rails mounted on the floor pan of the motor vehicle. A seat can thus be adjusted to a position which is

comfortable for the occupant of the seat. In such a situation it has been proposed to provide an electrical connection to a safety device mounted on the seat in the form of a wire or cable which extends from the seat to the main wiring loom of the vehicle. This wire or cable is generally located beneath the seat. The cable can become worn or damaged if the position of the seat is adjusted many times, and also the wire or cable may be become snagged or damaged if objects are placed under the seat.

There is an increasing demand for vehicles in which seats can be completely removed from the vehicle in order to enhance the space available for transporting items within the vehicle. It has previously proved impracticable to provide a safety device in such a seat which requires electric power or other signals from the main wiring loom of the vehicle. It would not be appropriate to provide a wire which would need to be plugged in when a seat is re-placed in a vehicle, since many owners of vehicles may not connect such plugs when installing seats in vehicles.

The present invention seeks to provide an improved safety arrangement in which electric power and/or control signals to activate a safety device can be passed reliably to a seat which is movably mounted within a motor vehicle, or which may be completely removed from the motor vehicle.

According to this invention there is provided a safety arrangement for use in a motor vehicle, the safety arrangement comprising at least one rail provided on the floor of the vehicle and a vehicle seat movably mounted on the rail, the rail being associated with one or more transmitting antennas and the seat being associated with one or more receiving antennas, and means to supply a signal to at least one transmitting antenna to transfer power to at least one receiving antenna, there being a safety device mounted in or on the seat, actuating means being provided to use the power transferred to the said receiving antenna to actuate the said safety device.

In a preferred embodiment the transmitting antennas that are associated with the rail extend immediately adjacent the rail or, in a most preferred embodiment, are mounted in or on the rail. Also it is preferred that the one or more receiving antennas assoicated with the seat are mounted on a part of the seat immediately adjacent the rail, with the antenna or antennas preferably being mounted on part of the seat that engages the rail.

Preferably the or each transmitting antenna is in the form of at least one electromagnetic coil, and the or each receiving antenna is in the form of at least one electromagnetic coil.

The primary and secondary coils may be each wound about a vertical axis.

Conveniently the signal supplied to the primary coil or coils has a frequency of substantially 20 kHz.

Advantageously the rail is provided with a plurality of said primary coils at positions spaced along the length of the rail.

Preferably the or each primary coil is of elongate form, the longitudinal axis of the coil being aligned with the axis of the rail.

Conveniently selector means are provided adapted to select the primary coil or coils which receive power to be transferred to a secondary coil or coils, there being a seat position sensor adapted to sense the position of the or each seat mounted on the rail, and to control the selector means in dependence upon the sensed position of the or each seat to supply the power to one or more primary coils adjacent the or each seat.

Preferably the or each secondary coil is connected to the actuating means via rectifier means.

Advantageously a plurality of secondary coils are provided, each of the secondary coils being connected to a respective rectifier means, the output of the rectifier means being connected in parallel to the actuating means.

Conveniently three secondary coils are provided, and two secondary coils are located adjacent each other, with the third secondary coil over-lapping the two adjacent secondary coils.

Preferably the length of each of said three coils is approximately one-half the length of the seat.

Advantageously each coil is provided with a ferrite core.

In an alternative embodiment the transmitting antenna comprises a first loop antenna extending adjacent the seat along substantially the whole length of the rail, and the receiving antenna comprises a corresponding loop antenna mounted on the seat adjacent the said first loop antenna.

Preferably the signal supplied to the first antenna has a frequency of approximately 10 MHz.

Conveniently a capacitor is provided in the seat, power from the receiving antenna being used to charge the capacitor, means being provided to cause the capacitor to discharge to actuate the safety device in response to an accident being detected.

Preferably the means to cause the discharge of the capacitor comprise a crash sensor and means to transmit a predetermined signal in response to the detection of a crash, the seat being provided with means to receive the signal and means to respond to the received signal to discharge the capacitor to actuate the safety device.

Conveniently the transmitting and receiving means are adapted to transmit the signal via said transmitting and receiving antennas.

In an alternative embodiment a crash sensor is provided adapted to activate said signal supplying means in response to the detection of a crash.

Preferably the vehicle seat which is movably mounted on the rail is mounted for axial movement along the rail.

Alternatively, or additionally, the vehicle seat which is movably mounted on the rail may be mounted to be removable from the rail.

Preferably means are provided to sense the condition of the seat and to inhibit actuation of the safety device if the seat is in a predetermined condition.

Advantageously the means to determine the position of the seat are adapted to generate a predetermined signal if the seat is in a folded condition resembling a table to inhibit actuation of the safety device whilst the seat is in that condition.

Conveniently the seat incorporates a safety device which comprises a pyrotechnic charge, and the actuating means comprises a squib to ignite the

pyrotechnic charge, the squib being adapted to receive power from the receiving antenna.

The safety device may comprise a pyrotechnic pre-tensioner, or an air bag.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a part block diagram and part schematic illustration of a vehicle seat mounted in position on a rail, forming part of one embodiment to the invention.

FIGURE 2 is a scrap sectional view of the arrangement of Figure 1 showing part of the vehicle seat and part of the rail,

FIGURE 3 is a perspective view, partly in phantom, illustrating the rail and part of the seat,

FIGURE 4 is a diagrammatic view illustrating the relative position of primary coils mounted on the rail and secondary coils mounted on the seat in various positions of adjustment of the seat,

FIGURE 5 is a circuit diagram illustrating part of the described embodiment of the invention,

FIGURE 6 is a diagrammatic side view illustrating a vehicle seat and apparatus for transmitting control signals to the seat, forming a second embodiment of the invention.

FIGURE 7 is a block diagram of the first embodiment of the invention, and

FIGURE 8 is a block diagram of the second embodiment of the insertion.

Referring now to Figure 1 of the accompanying drawings, a vehicle seat 1 is illustrated comprising a squab 2 and a back 3. Mounted on the seat 1 is a pre-tensioner 4 which incorporates a pyrotechnic arrangement which can be actuated in the event that an accident should occur. The seat and the pre-tensioner are of a conventional form.

The seat is mounted on a carriage 5. The carriage 5 has depending elements 6 which co-operate with rails 7 mounted on the floor 8 of a motor vehicle so that the seat may slide backwardly and forwardly axially along the rails. Mounted within one of the rails 7 is a plurality of spaced apart transmitting antennas constituted by primary electromagnetic coils 9 as will be described hereinafter in greater detail, and mounted on the carriage 5 supporting the seat, is at least one receiving antenna constituted by one or more secondary electromagnetic coils which form a secondary coil arrangement 10. The secondary coil arrangement 10 is mounted adjacent and immediately above a primary coil 9 regardless of the position of the seat 1 on the rails 7.

It is preferred that the transmitting antennas are mounted immediately adjacent one of the rails or within one of the rails, as described above, with the receiving antenna being mounted on part of the seat that is immediately adjacent the rail, such as the carriage 5 that supports the seat, and which also engages the rail, as described above, since in this way the transmitting lobe of the transmitting antenna and the receiving lobe of the receiving antenna can easily be made to inter-

sect, providing an excellent coupling between the transmitting antenna and the receiving antenna.

The secondary coil arrangement 10 is connected, by means of a lead 11, to a squib adapted to activate the pyrotechnic arrangement in the pre-tensioner 4, thus causing the pre-tensioner to function.

The primary coils 9 are fed with a relatively low frequency alternating signal generated by a signal generator 12 in response to an accident being detected by a crash sensor 13.

A diagnostic circuit 14 is also connected to the coils 9.

It is to be appreciated, therefore, that in response to an accident being sensed by the sensor, the signal generator 12 will generate an alternating current signal having a frequency of, for example, 20 kHz. The signal is fed to the primary coils 9 and, regardless of the position of the seat 1, a current is generated in the secondary coil arrangement 10 provided in the seat. Thus power is transferred from the transmitting antenna to the receiving antenna. The current from the secondary coil arrangement 10 is passed to the squib that forms part of the pyrotechnic device, thus causing the pre-tensioner to be actuated.

Referring now to Figure 3 of the accompanying drawings, the element 6 depending from the carriage 5 of the seat, together with the associated secondary coil arrangement 10 is illustrated in greater detail together with the rail 7 and the primary coils 9. It is to be appreciated that the rail 7 and the depending element 6 from the carriage of the seat have been illustrated purely schematically and illustrate co-operating elements which enable the carriage 5 to slide axially along

the rail. Many different designs are well known to those skilled in the art, and consequently, the present illustration is primarily schematic.

At spaced apart positions along the rail 7 are three separate primary coils 9. Each primary coil is a substantially flat horizontal rectangular coil 15 which surrounds at least part of a ferrite block 16.

The primary coils 9 are preferably mounted within the rail 7 but, alternatively, may be mounted immediately adjacent the rail.

The primary coils 9 would, in a practical embodiment of the invention, be slightly spaced apart from each other. Each coil is of elongate form having a longitudinal axis which is aligned with the longitudinal axis of the rail. The length of each coil is approximately half the length of the seat. The distance between the adjacent primary coils is a quarter of the length of the seat.

As can be seen, located above the primary coils 9, is the secondary coil arrangement 10. The secondary coil arrangement actually comprises three secondary coils 16,17,18. The secondary coils 16 and 18 are located in a common plane adjacent each other, and the secondary coil 17 overlaps the coils 16 and 18, the mid point of the coil 17 being substantially aligned with the point where the coils 16 and 18 are immediately adjacent each other. Each of the coils 16,17,18 is of longitudinal rectangular form having a longitudinal axis which extends substantially parallel with the rail 7. Each coil 16,17,18 has a length which is substantially equal to half the length of the seat. Each coil 16,17,18 comprises an outer coil which is formed on a ferrite core, and lies in a horizontal plane.

The secondary coil arrangement 10 is preferably mounted on part of the seat that engages the rail, such as the depending elements 6 which are associated with

the carriage 5 which supports the vehicle seat 1. An arrangement of this type optimises the coupling between the primary coils 9 and the secondary coil arrangement 10.

The air gap between the primary coils and the secondary coil arrangement is at a minimum.

Referring now to Figure 4 of the accompanying drawings, three primary coils P1, P2 and P3 are illustrated at spaced apart positions. As indicated by the reference numeral 20, a combination of three secondary coils identified as secondary coils S1, S2 and S3 is shown mounted in a predetermined position relative to the primary coils. It can be seen that the primary coil P1 is aligned with the secondary coil S1, meaning that the coupling function r between the primary coils and the secondary coils will be 100%.

If the seat carrying the secondary coils is slid along the rail to a second position as illustrated at 21 in Figure 4, it can be seen that the primary coil P1 is aligned with part of the secondary coil S1 and the primary coil P2 is aligned with part of the secondary coil S3. Although the coils are not totally aligned there is still an adequate coupling between the coils and the total coupling function in this position is 75%.

When the seat is moved further to have the position indicated by the reference numeral 22, the secondary coil S3 is aligned with the primary coil P2 giving a coupling function of 100%.

As can be seen, as the seat occupies further positions as indicated by the reference numerals 23,24,25,26,27 and 28, in each position one secondary coil is

aligned with one primary coil or two secondary coils are partially aligned with two primary coils meaning that the coupling function is always 75% or greater.

Consequently, by providing a number of primary coils spaced along the rail and by providing the three secondary coils, two of which are off-set relative to each other and the third of which effectively over-laps part of the two off-set coils, regardless of the position of the seat an adequate coupling function can be achieved. The length of the seat is shown in Figure 4.

Referring now to Figure 5 of the accompanying drawings, the three secondary coils 16,17,18, provided at one side of the seat are illustrated, these coils being coupled to a primary coil 9. The figure also shows three further coils provided at the opposite side of the seat. These coils would function in the same way as the coils 16,17,18 if the seat were reversed so as to face the opposite way within the motor vehicle. Here it is to be understood that the invention relates to seats which are remountably mounted on the rail, and includes seats that may be removed from the rail, reversed in position and then re-mounted on the rail. When mounted on the rail such seats may be slidable along the rail, or may be prevented from sliding along the rail.

It can be seen that each coil 16,17,18 is connected to a respective rectifying diode bridge 30,31,32, the outputs of the diode bridges being connected in parallel. One output of the diode bridges is connected to a filter 33, which filters out spurious signals, the output of the filter being connected to a squib 34. The other outputs of the diode bridges are connected by means of a rail 35 to the squib 34.

Consequently, it will be appreciated that when an appropriate alternating current signal is passed through the primary coil 9, that signal will be coupled to the secondary coils 16,17,18 and will generate a voltage across the secondary coils.

The voltage generated across the secondary coils will be rectified by the diode bridges 30,31,32 and the rectified voltage will be applied to a squib 34. Only the secondary coil having the highest voltage across it will drive a current through the squib. The squib 34 will actuate a pyrotechnic charge which will in turn actuate the safety device provided in the seat which is, in the example given, a pre-tensioner.

In the embodiment described with reference to Figures 1 to 5, the alternating current generator 12 is activated in response to the occurrence of an accident. In an alternative embodiment of the invention, however, the alternating current generator functions continuously, and electric power is coupled through the co-operating primary and secondary coils to a capacitor within the seat which stores electric charge. When an accident occurs, a control signal is passed to an appropriate control arrangement in the seat, which will be described hereinafter, which causes the capacitor to discharge through the squib, thus actuating the safety device. The control signal may be a coded signal which is transmitted by an appropriate transmitter. The control signal may be transmitted through the above-described co-operating primary and secondary coils, but separate means may be provided to pass the control signal to the control arrangement.

Figure 6 illustrates a vehicle seat 40 which is provided with squab 41 and a back 42, and which has mounted thereon a safety device in the form of a pyrotechnic pre-tensioner 43. The seat is mounted on a carriage 45 for sliding movement along rails (not shown). Mounted on the carriage is an elongate receiving loop antenna 46. The loop antenna is connected to a control device 47 mounted within the seat which is adapted to actuate the safety device. A further loop antenna 48, in the form of a transmitting antenna is provided which extends the entire length of the rail (not shown) upon which the seat is to be mounted. The

loop antenna 48 is adapted to receive a high frequency signal, for example a 10 MHz signal from a signal source 49.

The receiving loop antenna is preferably mounted on part of the carriage that is immediately adjacent the rails, and the loop antenna 48 may be mounted immediately adjacent the rail or preferably may be mounted within or on the rail. Such an arrangement may provide an optimum coupling between the two loop antennas.

The signal source 49 is associated with a crash sensor 50.

It is to be appreciated that the signal generated by the signal source 49 is fed to the loop antenna 48, and is transmitted by that antenna. The transmitted signal is detected by the loop antenna 46, regardless of the position of the seat 40 relative loop antenna 48, because in all positions of the seat the loop antenna 46 is located adjacent to part of the loop antenna 48. The received signal is passed to the control device 47 mounted within the seat.

In use of the described arrangement the source 49 may be activated in response to a signal from the sensor 50, and when the high frequency signal has been transmitted by the loop antenna 48 and received by the loop antenna 46, the signal causes the control device 47 to actuate the safety device which, in this example, in the form of the pre-tensioner 43 by passing a current through a squib which activates a pyrotechnic charge forming part of the pre-tension. In an alternative arrangement the signal source 49 generates a continuous signal which is received by the loop antenna 46. This signal might be used, for example, to charge a capacitor within the control device 47. In response to the sensing of a crash by the sensor 50, the signal source 49 transmits a coded signal which is received by the loop antenna 46 and which is decoded by appropriate decoding means within the

control device 47, the control device 47 in responding by activating the pyrotechnic pre-tensioner 43.

Referring now to Figure 7 which is a block diagram of the first described embodiment of the invention, a 20 kHz signal generator 51 is illustrated, the output of which is connected, by means of a main switch 52, to a bus bar 53. The bus bar 53 is connected by means of separate switches 54, 55, 56, 57 to separate primary transmitting electromagnetic coils 58, 59, 60, 61. The primary coils are each connected to impedance measurement circuit 62, the function of which will be described hereinafter. A central processing unit 63, for example in the form of a micro-processor is provided connected to the main switch and also connected to the impedance measurement circuit 62. A crash sensor 64 is provided which is connected to the central processor unit 63.

The primary coils 58-61 are mounted at spaced apart positions along the length of a rail on which a seat is slideably mounted.

Mounted on the seat are a plurality of secondary coils 65, 66, 67. The secondary coils are each being connected to a squib 68, which is adapted to activate a pyrotechnically deployed safety device provided on the seat.

The primary coils 58-61 are preferably mounted in position immediately adjacent the rail or, most preferably, on or in the rail. The secondary coils 65-67 are preferably mounted on part of the seat immediately adjacent the rail, the most preferred location being the part of the carriage on which the seat is supported that actually engages the rails.

In ordinary use of the arrangement shown in Figure 7, the impedance measurement circuit 62 will measure the impedance of each of the primary coils

58, 59, 60 and 61 sequentially, and from the measured values calculations are made concerning the location of the seat. It is to be understood that the impedance of a primary coil, as measured by the impedance measuring circuit 62, will depend upon whether the secondary coil arrangement 65, 66, 67 is adjacent the coil, in the vicinity of the coil or remote from the coil. From signals obtained by the impedance measurement circuit it is also possible to effect a diagnosis as to the condition of the squib in order to confirm that the squib's functioning in a satisfactory manner. The impedance of the primary coil is, of course, dependant to a certain extent on impedance existing across the terminals of an adjacent secondary coil. Consequently, it is possible to confirm, by making appropriate measurements, that the squib is functioning.

The impedance measurement circuit is connected to each of the switches 54, 55, 56, 57 and the impedance measuring circuit 62 will act to close the switches of the primary coils which are located closest to the secondary coil arrangement carried by the seat. If the coils have the relative position as shown in Figure 7, the impedance measurement circuit will render the switch 55 conductive so that the primary coil 59 is connected to the bus bar 53.

In the event that an accident should occur and be sensed by crash sensor 64, an appropriate signal is passed at the central processing unit 63 which closes the main switch 52, thus causing a 20 kHz signal to be applied to the bus bar 53. The signal will pass through the closed switch 55 to the primary coil 59 and will consequently transfer power to the secondary coil 66 which is substantially aligned (in the position illustrated in Figure 7) with the primary coil 59. The squib will thus be activated.

It is to be understood that if the seat is mounted on a very long rail, and if the rail has a length such that two seats may be accommodated, there may be a relatively

large number of primary coils adjacent each other and a first seat may be adjacent some of the primary coils with the second seat being adjacent others of the primary coils. In such an embodiment the impedance measurement circuit would close a switch or switches associated with the primary coils located in the vicinity of each seat, so that, in the event that a crash is sensed by the crash sensor 64, the signal passed by the signal generator 51 to the bus bar 53 will be passed to two or more spaced-apart primary coils and will thus be transferred to the secondary coil arrangements provided on both of the seats present on the rail.

Figure 8 is a block diagram of the arrangement shown in Figure 6.

Referring to Figure 8, a 10 MHz signal generator 70 is illustrated, the output of which is connected by means of a code modulator 71, adapted to modulate the signal generated by the signal generator, to a chassis antenna 72, which is a transmitting antenna in the form of a loop antenna. The chassis antenna is also connected to a demodulator decoder 73, which in turn is connected to a central processing unit 74. The central processing unit 74 is adapted to receive a signal from a crash sensor 75 and is also adapted to apply a controlling signal to the code modulator 71.

The chassis antenna 72 is a loop antenna which is located adjacent the rail, along which a seat may move, or which, in a preferred embodiment, is mounted in or on the rail. The seat is provided with a loop seat antenna 76, which, regardless of the position of the seat, is located adjacent the chassis antenna 72. The loop antenna 76, provided on the seat, is preferably mounted on part of the seat which is adjacent or which engages the rail along which the seat may move. The seat antenna 76 is connected to a charging circuit 77 which is adapted to charge a capacitor 78. The capacitor 78 is connected by means of a switch 79 to a squib 80 which is adapted to deploy a pyrotechnic safety device mounted in the seat.

The antenna 76 is also connected to a demodulator/decoder 81 which in turn is connected to a trigger 82, the trigger being connected to the switch 79. A sensor 83 is provided adapted to sense the state of seat occupancy, or, in otherwords, to determine whether the seat is occupied or unoccupied. The sensor 83 is connected to the trigger 82 so as to inhibit operation of the trigger 82 in the event that the seat is not occupied. The sensor 83, together with the squib 80, are connected to a coder demodulator 84. The coder modulator 84 has an input connected to the seat antenna 76 and also an output connected to the seat antenna 76.

In ordinary operation of the embodiment illustrated in Figure 8, the 10 MHz signal generator 70 generates a signal which passes through the coder modulator 71 to the chassi antennas 72, and the signal is transmitted. The transmitted signal, or at least part of the transmitted signal, is received by the seat antenna 76 and is passed to the charger circuit 77 to cause the capacitor 78 to charge up.

Under the control of the central processor unit coded signals are passed to the coder modulator which modulates the signal passed from the generator 70 to the antennas 72. Thus a modulated signal is received by the demodulator/decoder 81 and is also received by the coder modulator 84. The central processor unit will, from time to time, transmit coded signals which are received by the coder modulator 84, causing the coder modulator 84 to generate signals in response to the condition of the state of seat occupancy sensor 83 and in response to the condition of the squib 80, these coded signals being passed to the seat antennas 76. The coded signals are thus transmitted and are received by the chassis antenna 72, and passed to the demodulator/decoder 73 and thus to the central processing unit 74. Thus the central processing unit 74 may monitor the condition of the squib and may also monitor the condition of the state of seat occupancy sensor 83.

In the event that an accident is sensed by the crash sensor 75, an appropriate signal is passed to the central processor unit which will subsequently cause the coder modulator to pass a modulated signal to the chassi antenna 72. The modulated signal is received by the seat antenna 76 and is recognised by the demodulator/decoder 81. The demodulator/decoder 81 activates the trigger 82 which, if the state of seat occupancy sensor 83 enables the trigger because the seat is occupied, closes the switch 79, causing the charge on the capacitor 78 to pass to the squib 80, consequently deploying the safety device present in the seat.

It is to be appreciated that in the described embodiments of the invention there is no direct electrical connection between the seat and the rail on which the seat is mounted. Thus the seat may be totally removed from the rail, and may subsequently be replaced on the rail, without the person carrying out this operation being needed to complete any electrical connections. Also, of course, the seat may be moved along the rail to any appropriate position whilst electrical power from the primary coils may be passed to the secondary coils, thus rendering the safety device in the seat effective, without there being any wires that may become snagged or damaged.

If the embodiment is utilised in which the capacitor becomes charged up within the seat, it is not essential for there to be a particularly high coupling factor between the transmitting antenna and the secondary antenna, provided that the arrangement is such that the capacitor will be charged sufficiently to actuate the safety device within a short period of time after the motor vehicle is switched on.

CLAIMS:

1. A safety arrangement for use in a motor vehicle, the safety arrangement comprising at least one rail provided on the floor of the vehicle and a vehicle seat movably mounted on the rail, the rail being associated with one or more transmitting antennas and the seat being associated with one or more receiving antennas, and means to supply a signal to at least one transmitting antenna to transfer power to at least one receiving antenna, there being a safety device mounted in or on the seat, actuating means being provided to use the power transferred to the said receiving antenna to actuate the said safety device.

2. An arrangement according to Claim 1 wherein the or each transmitting antenna is in the form of at least one electromagnetic coil, and the or each receiving antenna is in the form of at least one electromagnetic coil.

3. An arrangement according to Claim 2 wherein the primary and secondary coils are each wound about a vertical axis.

4. An arrangement according to Claim 2 or 3 wherein the signal supplied to the primary coil or coils has a frequency of substantially 20 kHz

5. An arrangement according to any one Claims 2 to 4 wherein the rail is provided with a plurality of said primary coils at positions spaced along the length of the rail.

6. An arrangement according to any one of claims 2 to 5 wherein the or each primary coil is of elongate form, the longitudinal axis of the coil being aligned with the axis of the rail.

7. An arrangement according to Claim 5 or 6 wherein selector means are provided adapted to select the primary coil or coils which receive power to be transferred to a secondary coil or coils, there being a seat position sensor adapted to sense the position of the or each seat mounted on the rail, and to control the selector means in dependence upon the sensed position of the or each seat to supply the power to one or more primary coils adjacent the or each seat.

8. An arrangement according to any one of Claims 2 to 7 wherein the or each secondary coil is connected to the actuating means via rectifier means.

9. An arrangement according to any one of Claims 2 to 7 wherein a plurality of secondary coils are provided, each of the secondary coils being connected to a respective rectifier means, the output of the rectifier means being connected in parallel to the actuating means.

10. An arrangement according to any one of Claims 2 to 9 wherein three secondary coils are provided.

11. An arrangement according to Claim 10 wherein two secondary coils are located adjacent each other, with the third secondary coil over-lapping the two adjacent secondary coils.

12. An arrangement according to Claim 10 or 11 wherein the length of each of said three coils is approximately one-half the length of the seat.

13. An arrangement according to any one of Claims 2 to 12 wherein each coil is provided with a ferrite core.

14. An arrangement according to Claim 1 wherein the transmitting antenna comprises a first loop antenna extending adjacent the seat along substantially the whole length of the rail, and the receiving antenna comprises a corresponding loop antenna mounted on the seat adjacent the said first loop antenna.

15. An arrangement according to Claim 14 wherein the signal is supplied to the first antenna at a frequency of approximately 10 MHz.

16. An arrangement according to any one of the preceding claims wherein a capacitor is provided in the seat, power from the receiving antenna being used to charge the capacitor, means being provided to cause the capacitor to discharge to actuate the safety device in response to an accident being detected.

17. An arrangement according to Claim 16 wherein the means to cause the discharge of the capacitor comprise a crash sensor and means to transmit a predetermined signal in response to the detection of a crash, the seat being provided with means to receive the signal and means to respond to the received signal to discharge the capacitor to actuate the safety device.

18. An arrangement according to Claim 17 wherein the transmitting and receiving means are adapted to transmit the signal via said transmitting and receiving antennas.

19. An arrangement according to any one of claims 1 to 15 wherein a crash sensor is provided adapted to activate said signal supplying means in response to the detection of a crash.

20. An arrangement according to any one of the preceding Claims wherein the vehicle seat which is movably mounted on the rail is mounted for axial movement along the rail.

21. An arrangement according to any one of the preceding Claims wherein the vehicle seat which is movably mounted on the rail is mounted to be removable from the rail.

22. An arrangement according to any one of the preceding Claims wherein means are provided to sense the condition of the seat and to inhibit actuation of the safety device if the seat is in a predetermined condition.

23. An arrangement according to Claim 22 wherein the means to determine the position of the seat are adapted to generate a predetermined signal if the seat is in a folded condition resembling a table to inhibit actuation of the safety device whilst the seat is in that condition.

24. An arrangement according to any one of the preceding Claims wherein the seat incorporates a safety device which comprises a pyrotechnic charge, and the actuating means comprises a squib to ignite the pyrotechnic charge, the squib being adapted to receive power from the receiving antenna.

25. An arrangement according to Claim 24 wherein the safety device comprises a pyrotechnic pre-tensioner.

26. An arrangement according to Claim 24 wherein the safety device comprises an air-bag.

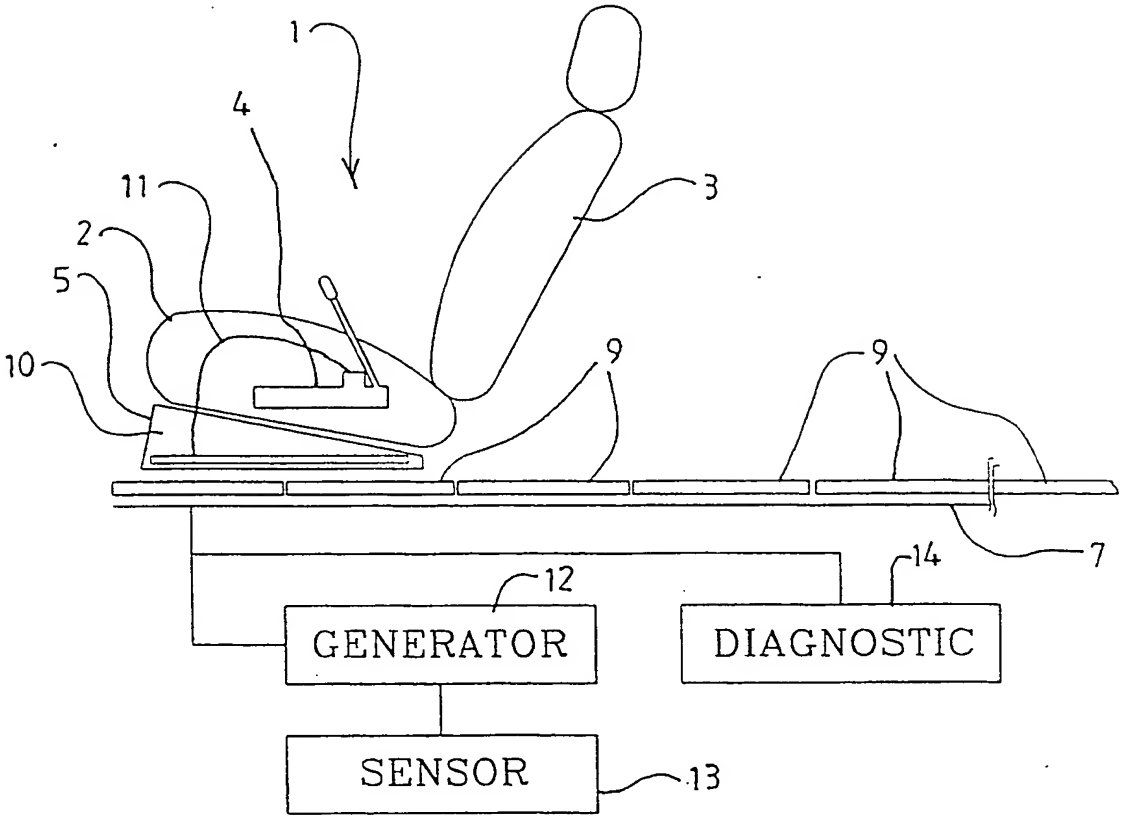
1
4
11
2
5
10
3
9
9
7
12
14
GENERATOR
DIAGNOSTIC
SENSOR
13

FIG 1

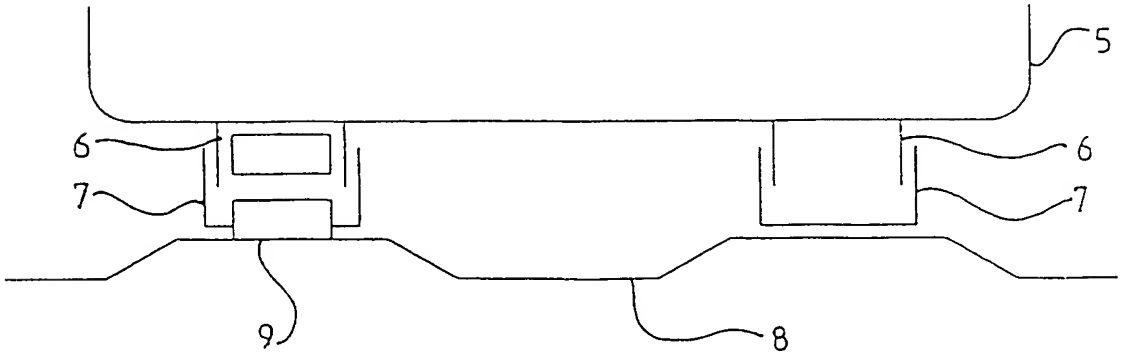
5
6
6
7
7
9
8

FIG 2

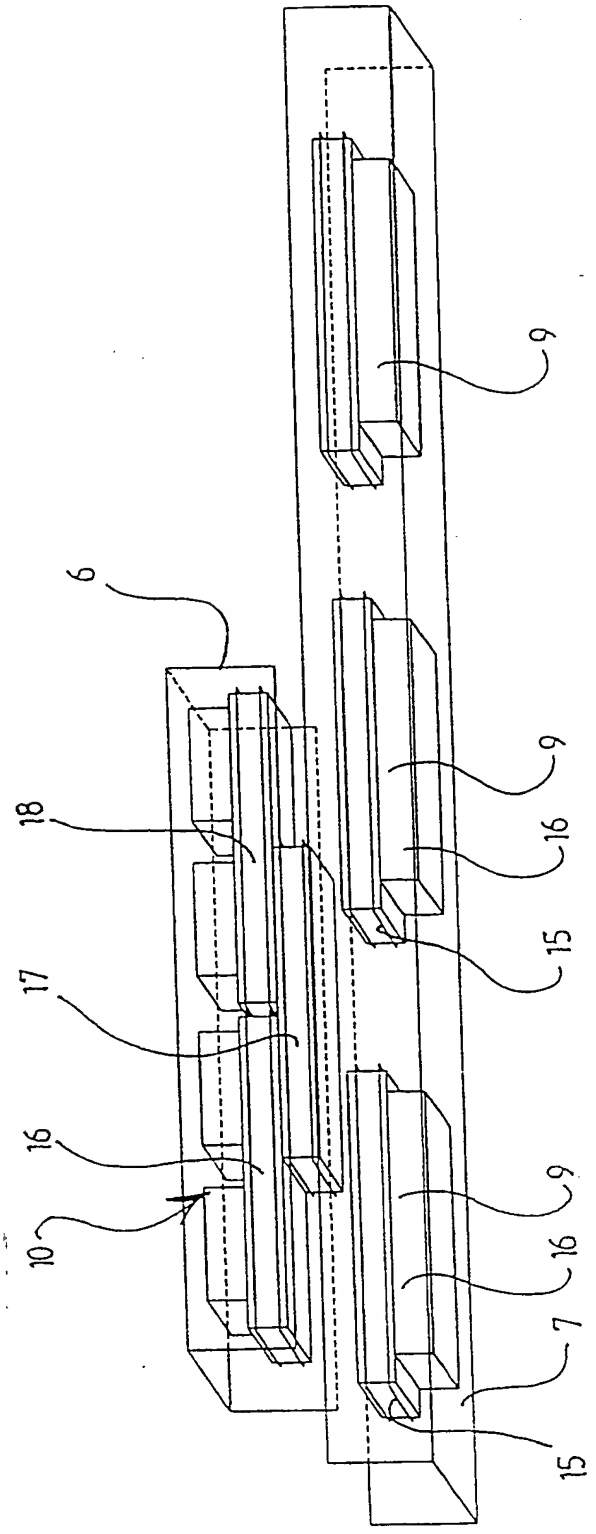

FIG 3

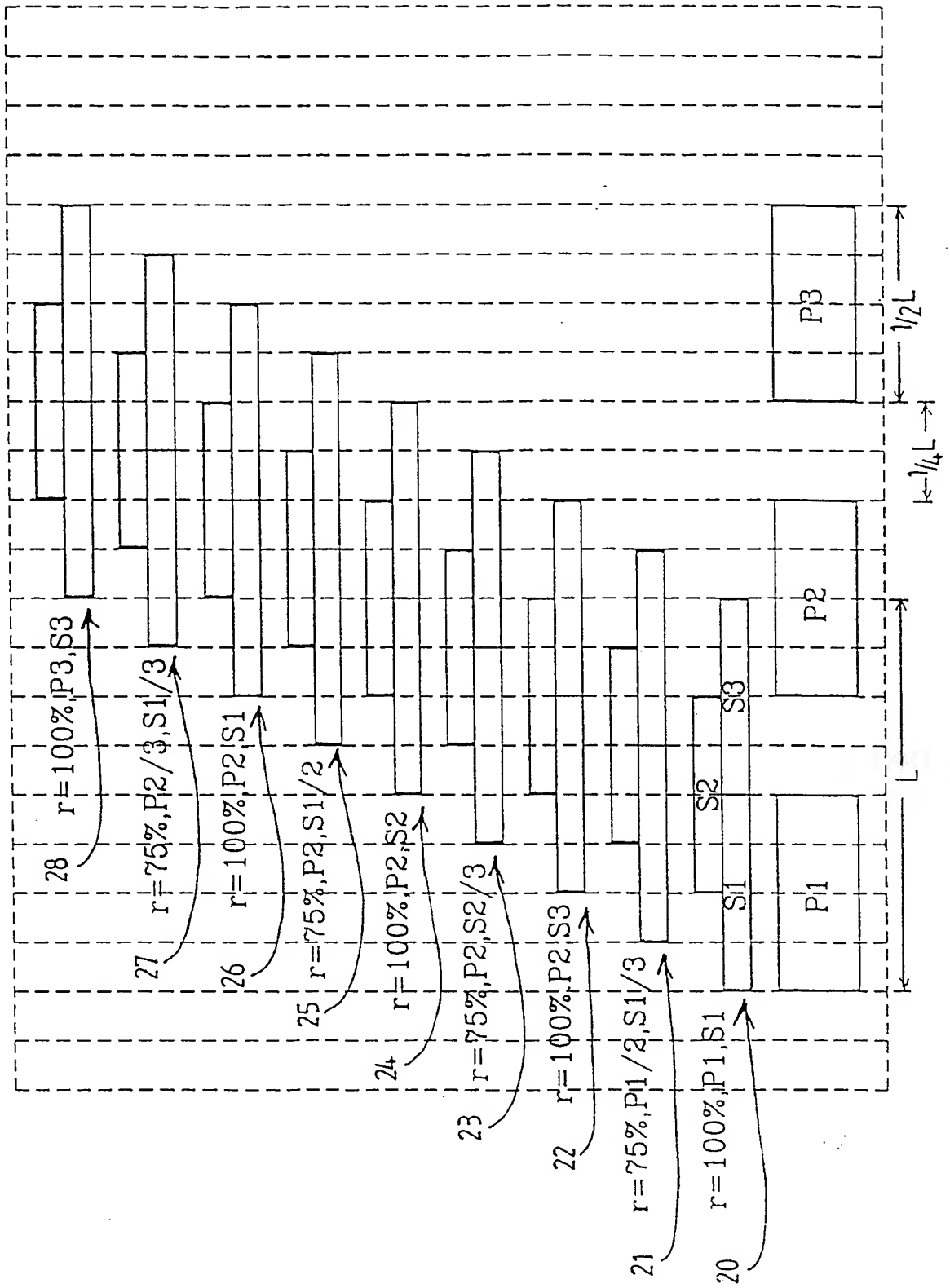
28 r=100%,P3,S3
27 r=75%,P2/3,S1/3
26 r=100%,P2,S1
25 r=75%,P2,S1/2
24 r=100%,P2,S2
23 r=75%,P2,S2/3
22 r=100%,P2,S3
21 r=75%,P1/2,S1/3
20 r=100%,P1,S1
P3
P2
P1
S3
S2
S1
1/2L
1/4L
L

FIG 4

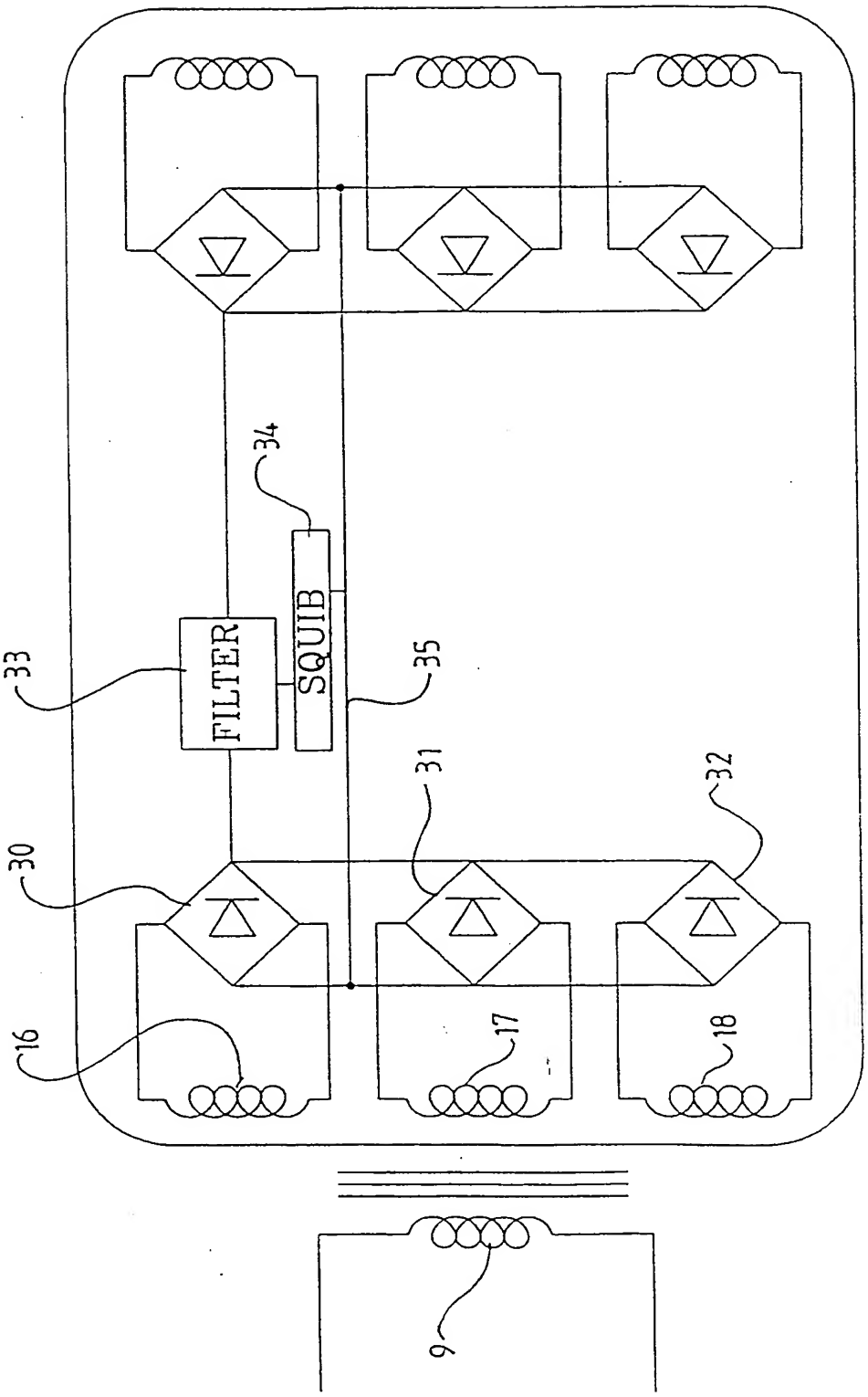

FIG 5

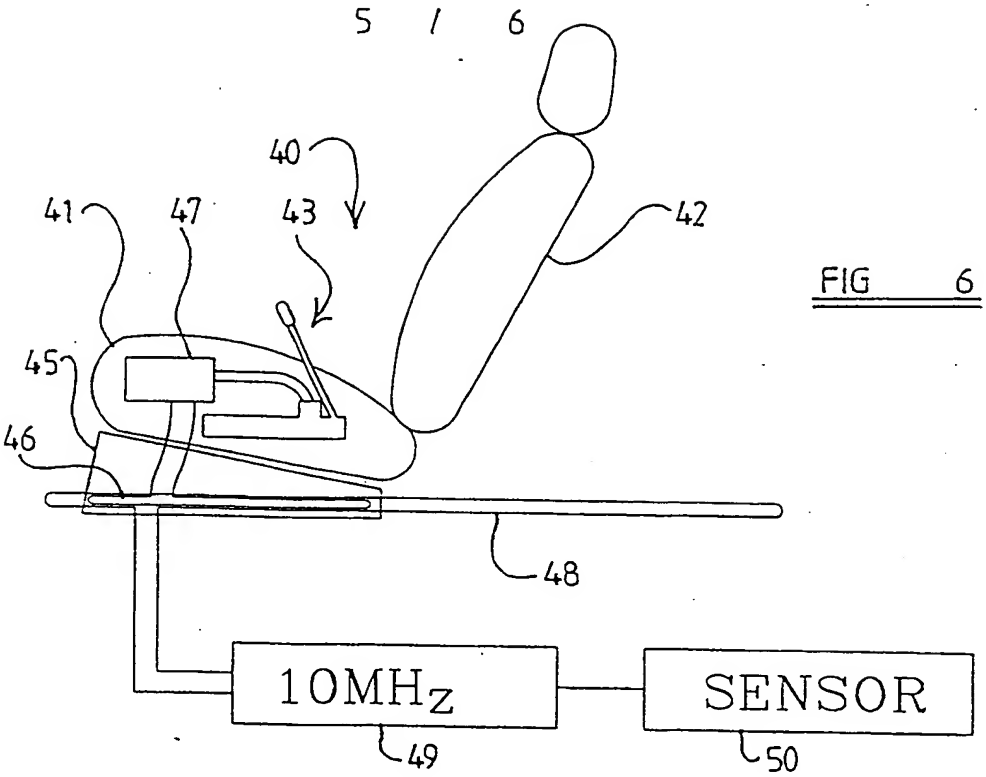
5
1
6
40
41
47
43
42
45
46
48
10MHz
SENSOR
49
50

FIG 6

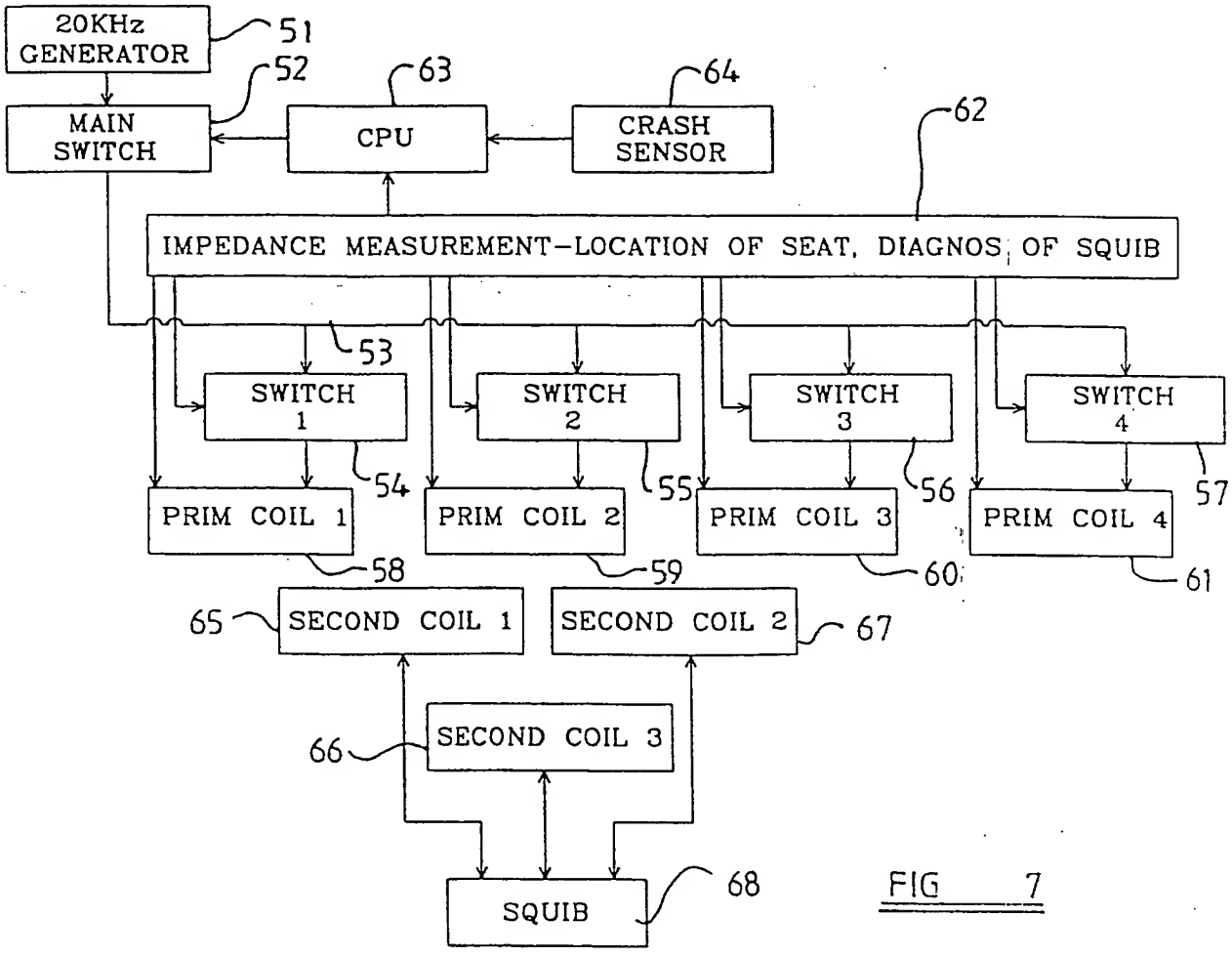
20KHz GENERATOR
51
52
63
64
MAIN SWITCH
CPU
CRASH SENSOR
62
IMPEDANCE MEASUREMENT–LOCATION OF SEAT, DIAGNOS OF SQUIB
53
SWITCH 1
SWITCH 2
SWITCH 3
SWITCH 4
54
55
56
57
PRIM COIL 1
PRIM COIL 2
PRIM COIL 3
PRIM COIL 4
58
59
60
61
65
SECOND COIL 1
SECOND COIL 2
67
66
SECOND COIL 3
SQUIB
68

FIG 7

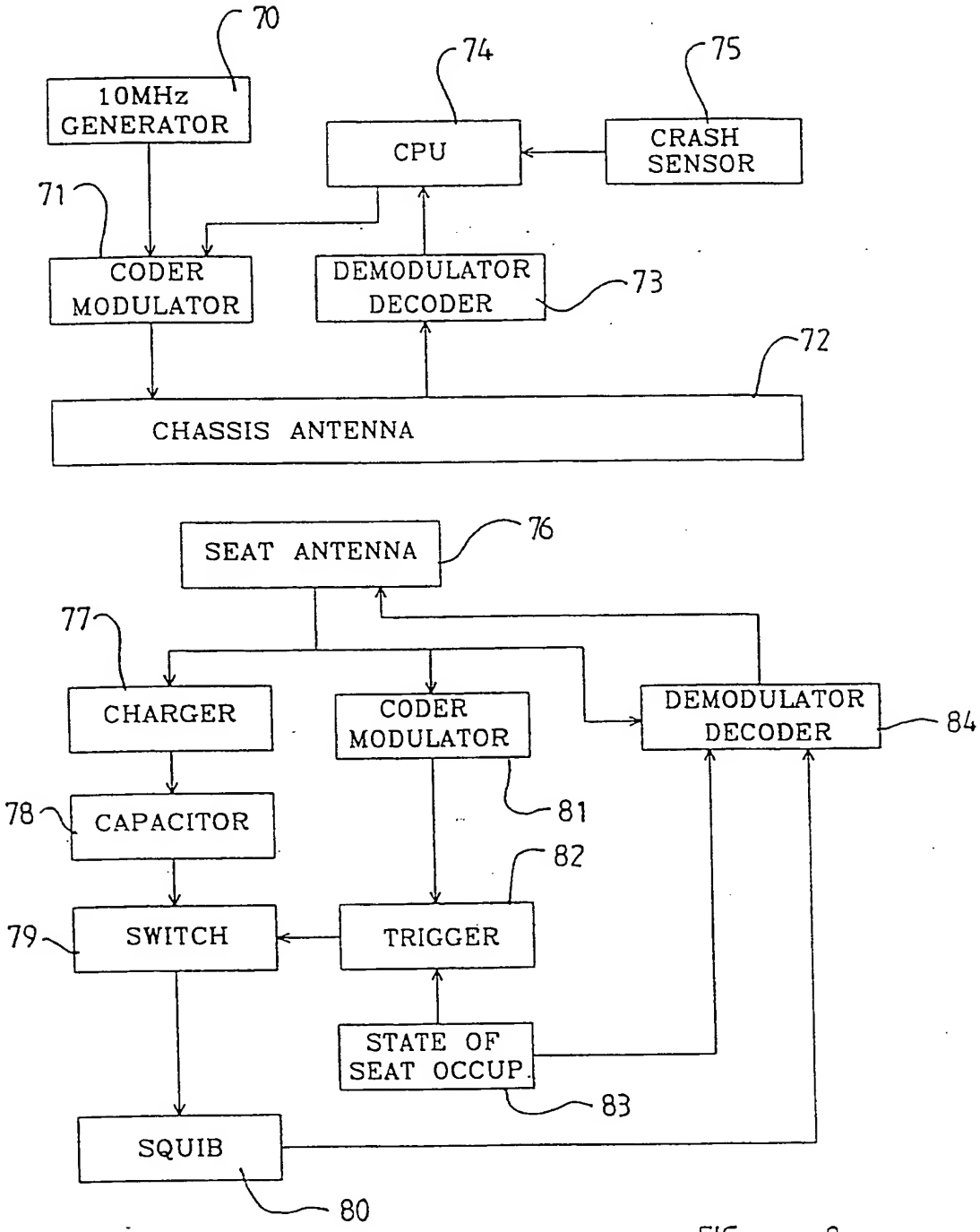
70
10MHz GENERATOR
74
CPU
75
CRASH SENSOR
71
CODER MODULATOR
DEMODULATOR DECODER
73
72
CHASSIS ANTENNA
SEAT ANTENNA
76
77
CHARGER
CODER MODULATOR
DEMODULATOR DECODER
84
78
CAPACITOR
81
82
79
SWITCH
TRIGGER
STATE OF SEAT OCCUP.
83
SQUIB
80

FIG 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/01435

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B60R 16/02, B60R 21/32, B60R 22/46
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B60R, B60N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 19545220 A1 (ROBERT BOSCH GMBH), 12 June 1997 (12.06.97), column 1, line 15 - line 28; column 3, line 54 - column 4, line 52	1-3,5,6, 10-14,19-21, 24-26
Y		4,8,9,15-18, 22,23
	--	
Y	EP 0520535 A1 (KOLBENSCHMIDT), 30 December 1992 (30.12.92), column 2, line 28 - line 46; column 3, line 43 - line 55	4,8,9,15-18
	--	
A	DE 19614161 A1 (GENERAL MOTORS CORP.), 17 October 1996 (17.10.96)	4,8,9,15-18
	--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 November 1998	16 -11- 1998
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Hans Nordström Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

05/10/98

International application No.
PCT/SE 98/01435

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19545220 A1	12/06/97	EP 0862524 A	09/09/98
		WO 9720710 A	12/06/97
EP 0520535 A1	30/12/92	CA 2071681 A	23/12/92
		DE 4120650 A	24/12/92
		DE 59203194 D	00/00/00
		ES 2077340 T	16/11/95
		JP 5201337 A	10/08/93
		MX 9203031 A	01/07/93
		US 5498911 A	12/03/96
DE 19614161 A1	17/10/96	JP 8322166 A	03/12/96
US 5324071 A	28/06/94	DE 4137719 A,C	24/09/92
		JP 5016758 A	26/01/93
		US 5466001 A	14/11/95
		JP 5016759 A	26/01/93
		JP 4358944 A	11/12/92
		JP 4358933 A	11/12/92
		JP 4362430 A	15/12/92
EP 0827871 A1	11/03/98	JP 10086723 A	07/04/98
		US 5696409 A	09/12/97
US 4932722 A	12/06/90	DE 3919295 A	08/02/90
		FR 2632910 A,B	22/12/89
		GB 2220128 A,B	04/01/90
		JP 1252910 A	09/10/89
WO 8905049 A1	01/06/89	EP 0419474 A	03/04/91
		GB 2221658 A,B	14/02/90
		SE 467679 B,C	24/08/92
		SE 8704506 A	18/05/89
		US 5034570 A	23/07/91

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/01435

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5324071 A (GOTOMYO ET AL.), 28 June 1994 (28.06.94), column 18, line 58 - column 19, line 16; column 19, line 42 - line 68	22,23
P,A	EP 0827871 A1 (TRW VEHICLE SAFETY SYSTEMS INC.), 11 March 1998 (11.03.98)	1,2,8,21,24, 25
A	US 4932722 A (MOTOZAWA), 12 June 1990 (12.06.90)	25
A	WO 8905049 A1 (SAAB-SCANIA AKTIEBOLAG), 1 June 1989 (01.06.89)	1